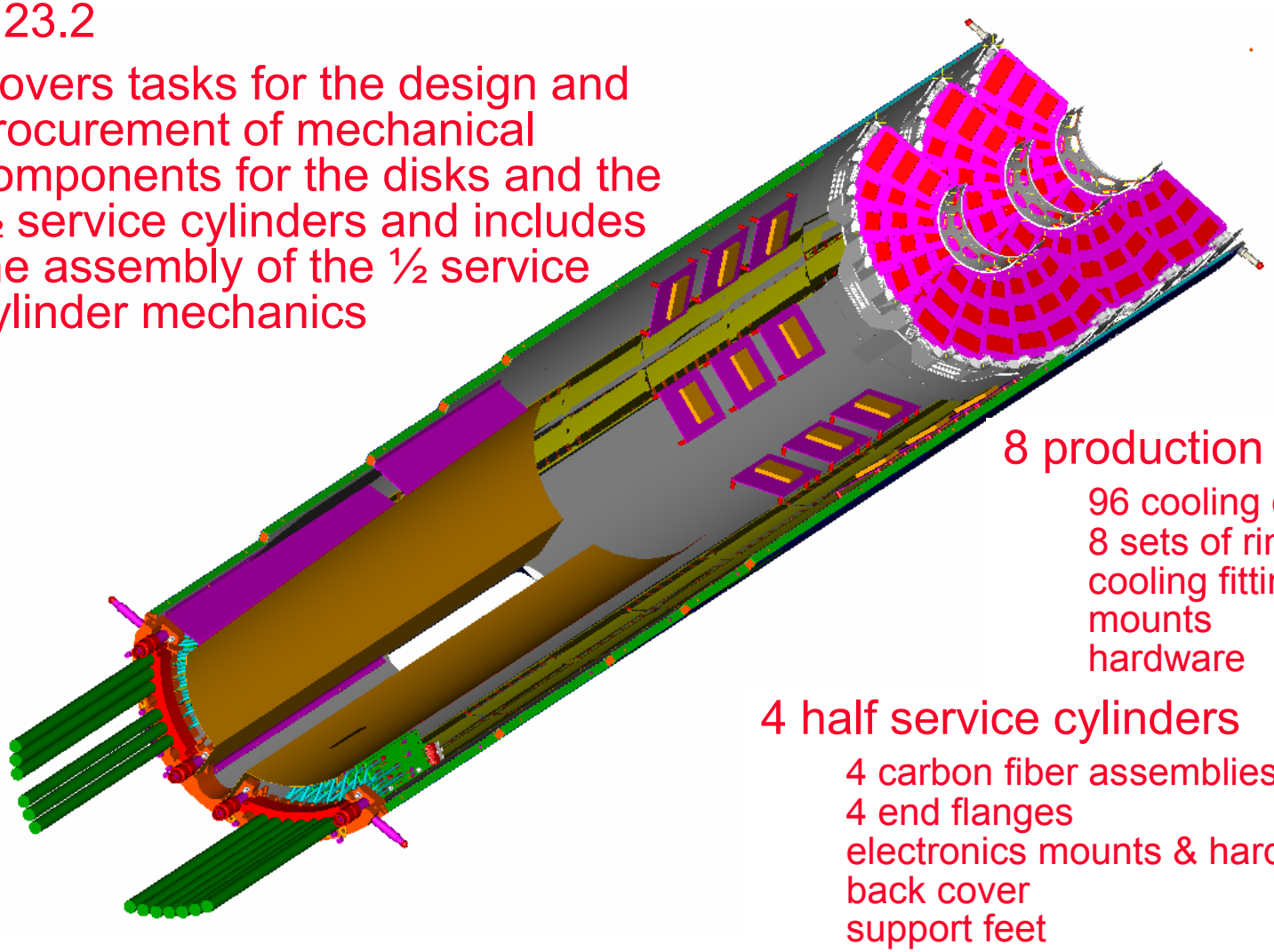
Mechanics Status
Disks, ½ Service Cylinders
Installation

USCMS FPIX FNAL PMG
Joe Howell
Bruno Gobbi
Nov. 29, 2006

Overview of the Detector Mechanics

5.23.2

Covers tasks for the design and procurement of mechanical components for the disks and the ½ service cylinders and includes the assembly of the ½ service cylinder mechanics



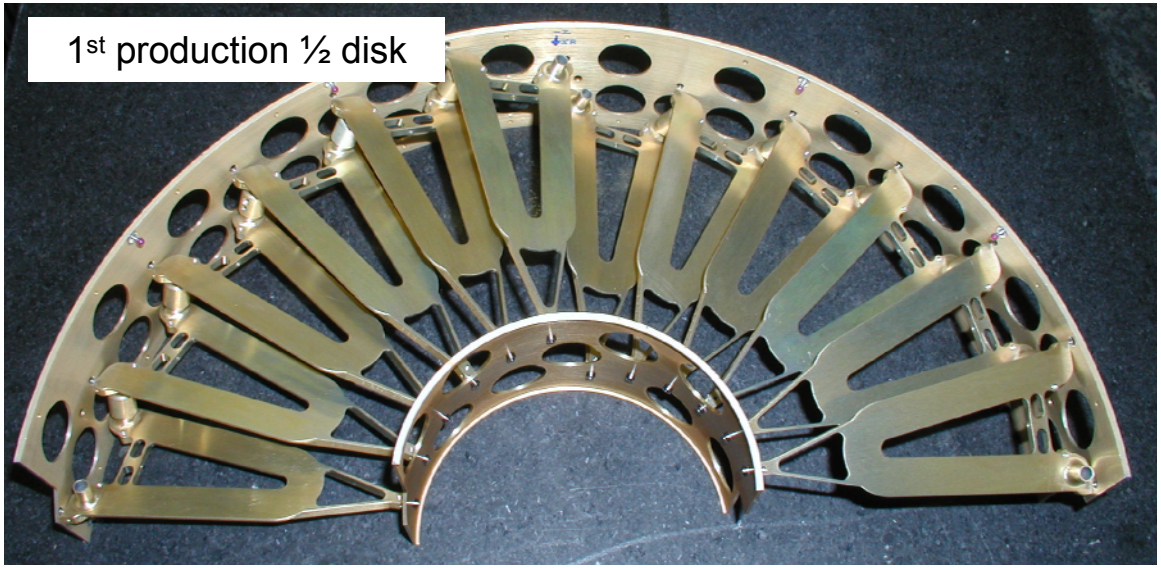
8 production ½ disks

- 96 cooling channels
- 8 sets of rings
- cooling fittings
- mounts
- hardware

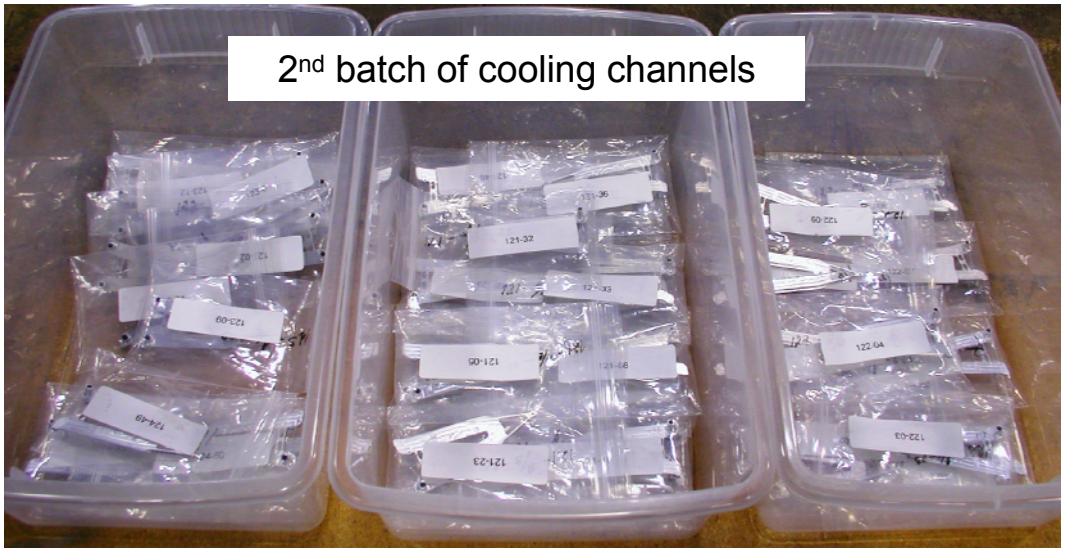
4 half service cylinders

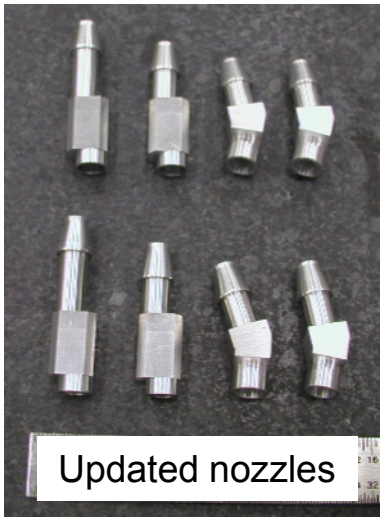
- 4 carbon fiber assemblies
- 4 end flanges
- electronics mounts & hardware
- back cover
- support feet
- manifold

Disk production

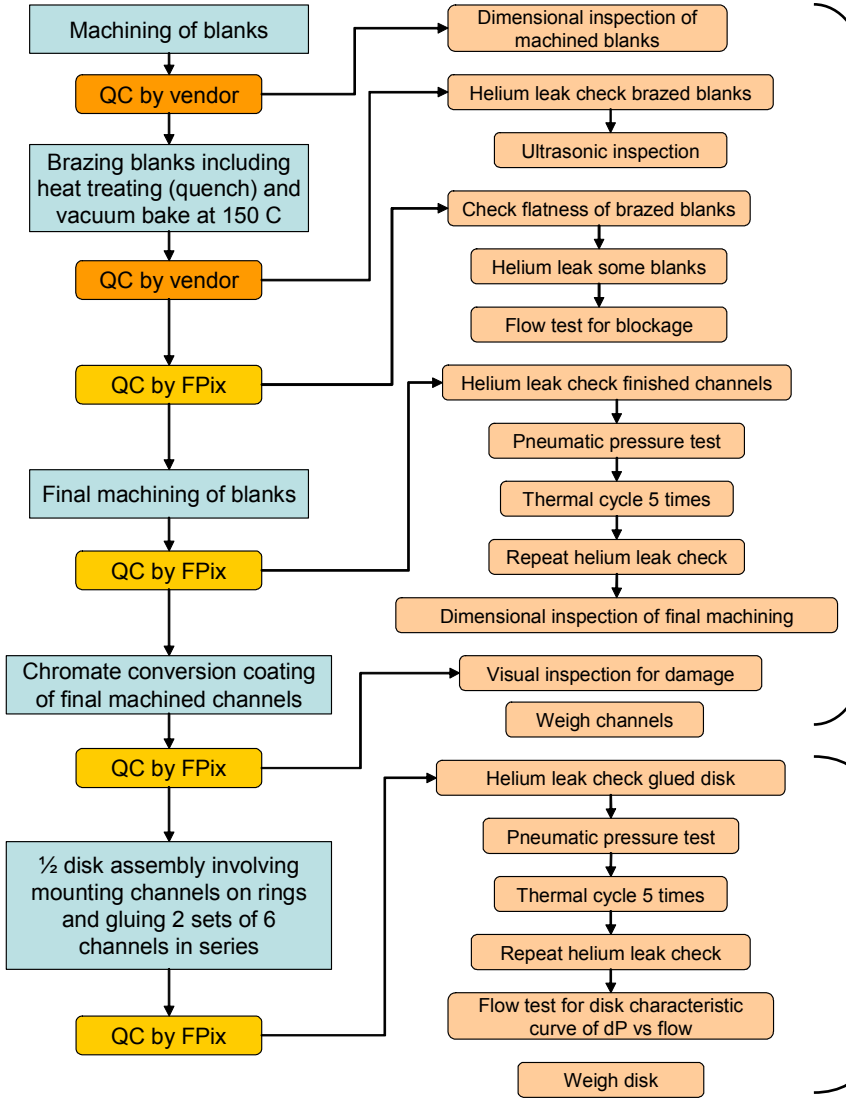


- Channels for almost 3 (-Z) disks complete
- Channels for almost 3 (+Z) disks ready for QA testing in ~ 1 week
- Nozzle design update complete
- Disk mount design prototype in process





Cooling channel & Disk production flow



Updated !5Aug06

Cooling channel QC steps

Final QC and coating of 1st batch of disks required ~ 3 weeks

Disk QC steps

Assembly and testing of 1st two production disks will required ~ 2 weeks

Cooling Channel Count

Part type		Channels required for 8 disks	Brazed blanks ordered	Brazed blanks received	Channels w/ final machining 95% complete	Channels completed	Channels damaged or failed QC*
121	Part types required for +Z disks	32	40	30	23	-	1
122		8	12	11	10	-	1
123		8	12	10	10	-	-
124	Part types required for –Z disks	32	40	33	5	26	2
125		8	12	9	-	5	-
126		8	12	8	-	7	1
	Totals	96	128	101	48	38	5

* 1 each of 121 & 124 – not repairable

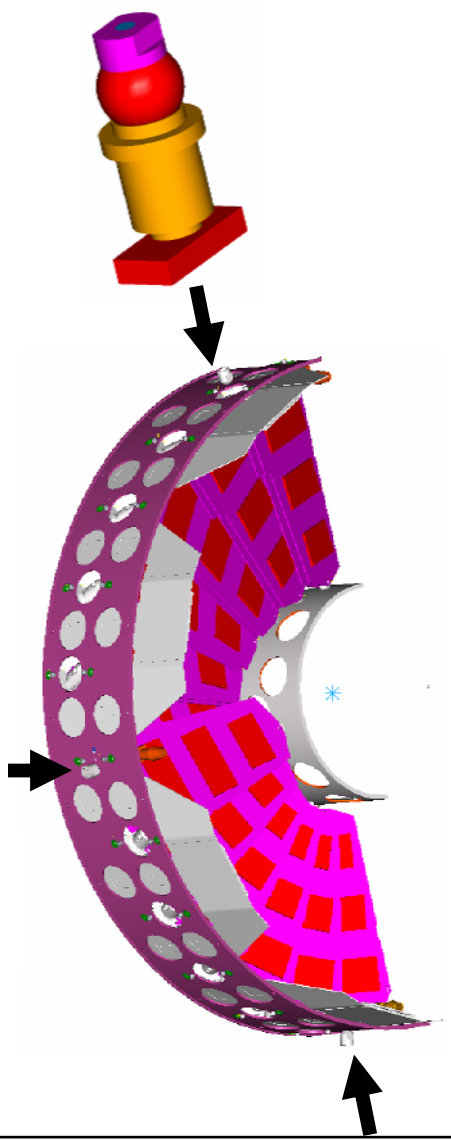
1 each of 122,124 & 126 out of flat

Production Disk parts status

Cooling channels	101 brazed blanks received, 38 complete (no leaks after final machining) 48 in final machining process (95% complete) final machining of last batch will begin when all blanks are received
Inner/Outer rings	Complete
Titanium Screws	Complete
PEEK Screws	Complete
Fiducial balls	Complete
Sleeves	Complete
Nipples	Machining complete for first two disks, coating in process. Fabrication of balance (24 parts) in process
Disk Mounts	Prototyping of kinematic design in process, Simple parts, short lead time

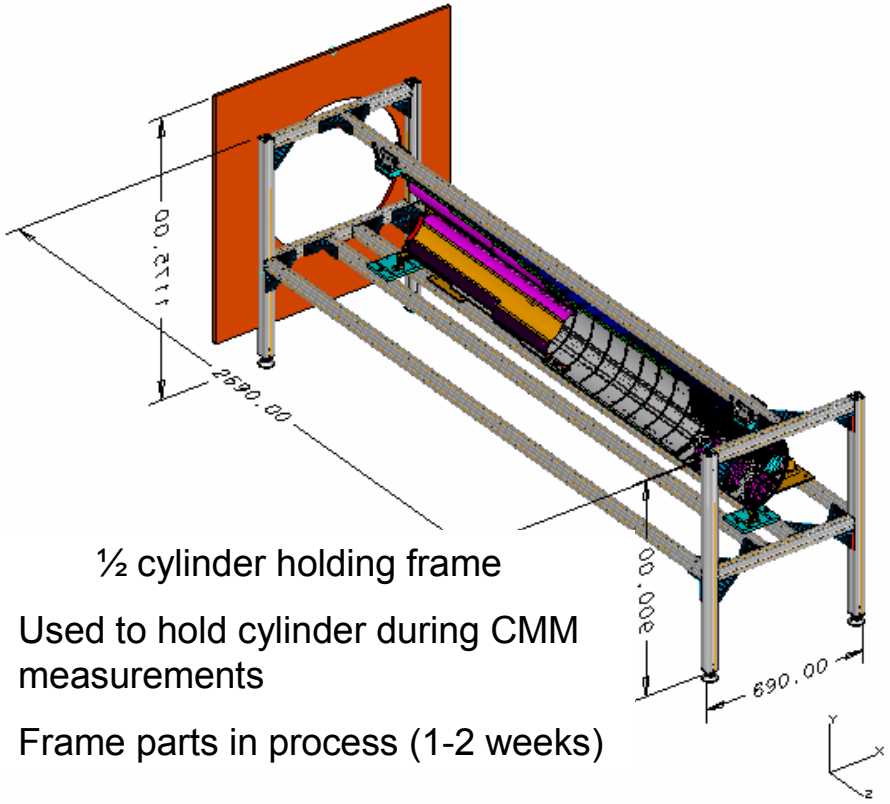
Disk mounts

Model of prototype mount



Mounts at 3 locations

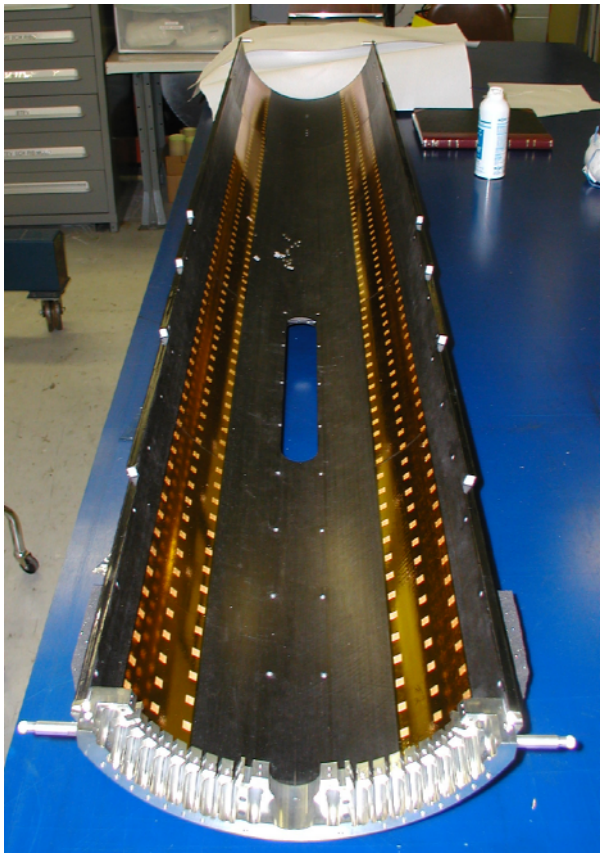
- Kinematic disk mount fits in existing bushings mounted in ½ cylinder
- Simple parts (prototypes in process)
- Drilled ruby balls in-hand (production quantity)
- Will evaluate design with disk mockups mounted in 1st production ½ cylinder



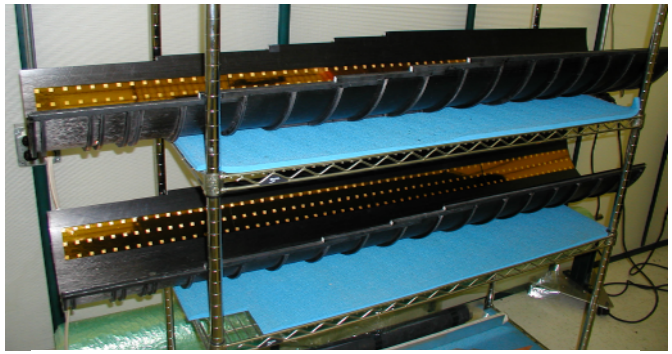
½ cylinder holding frame

- Used to hold cylinder during CMM measurements
- Frame parts in process (1-2 weeks)

Service ½ cylinder



1st production service ½ cylinder



3rd and 4th production service ½ cylinder CF assembly is started

2nd production service ½ cylinder CF assembly is 50% complete

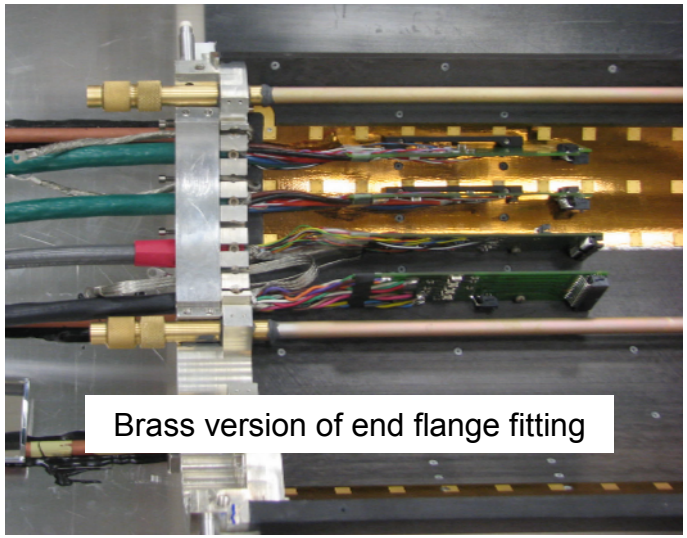
Back Cover

- Tooling completed
- Prototypes components laminated
- Evaluation of prototype in process

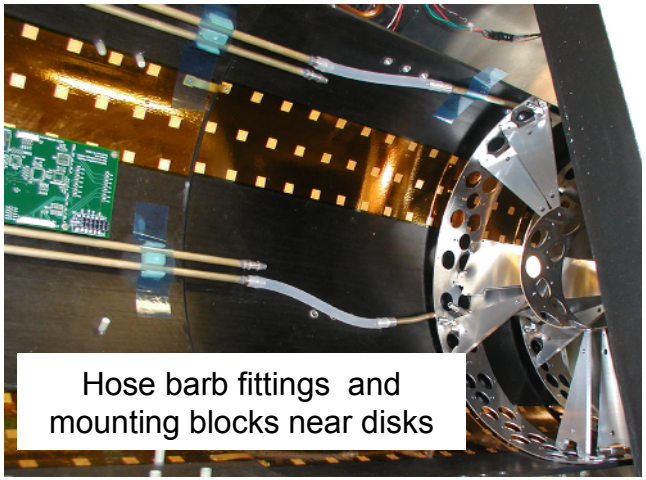
Service ½ cylinder status

Carbon fiber skins	Complete
Carbon fiber ribs	Complete
CF assembly	2 of 5 complete, remaining 3 are ~1/3 complete
End flange	Complete (possible rework to reduce mass)
Corner inserts	Complete
Disk mount bushings	Complete
Support feet	Complete
Fiducial balls	Ruby balls in hand, location under evaluation
Electronics mounts	Inserts installed in 07 detector, tooling updated, ½ production inserts on hand and balance in fabrication
Cooling manifold	Design review just completed, end fittings in fabrication, branch connection to be fabricated
Back cover	Tooling complete, prototype being evaluated for 07 detector
Fasteners	Complete except for distribution board screws

Cooling manifolds



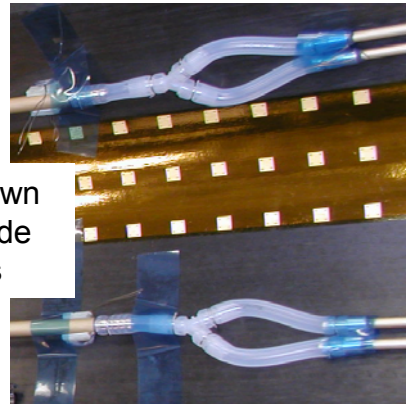
Brass version of end flange fitting



Hose barb fittings and mounting blocks near disks

- End flange fittings - match CERN standard fitting, parts in fabrication
- Hose barb fittings near disks, parts in fabrication
- Fittings for branch from supply or return to multiple disks, design reviewed, detailing in process
- Aluminum tubing, needs coating
- Mounting blocks – parts in fabrication
- Assembly and testing ~3 days per ½ cylinder
- Flex hose from Patch panel zero-to-½ cylinder, design not started, needed at installation

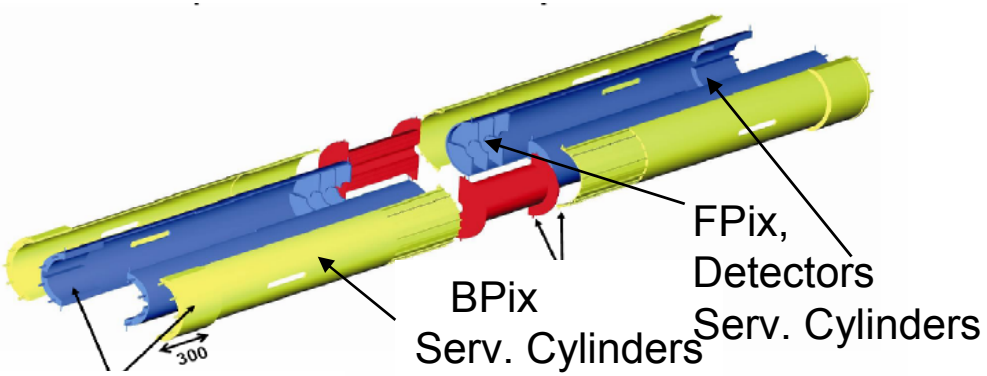
Branches like these shown in 07 detector to be made with machined blocks



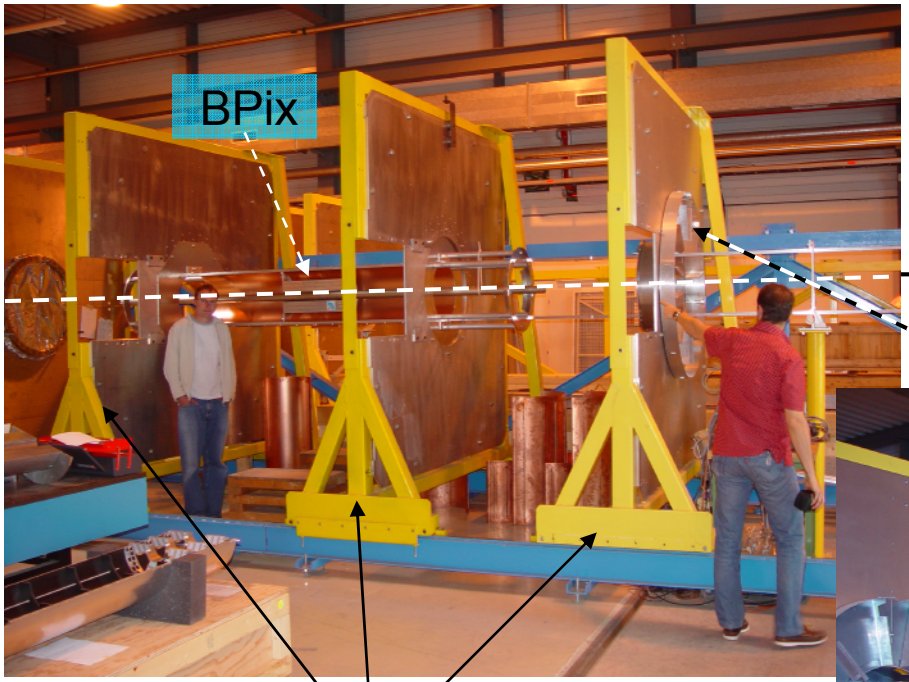
Installation of CMS Pixels

- The pixels will be the last CMS detectors to be installed, after the beam pipe is installed and surveyed.
- If the beam pipe is vented to air, it must be baked-out. The pixels must be removed to install a bakeout jacket around the beam pipe.
- Any access to the Pixel detector (repairs, replacing irradiated modules) will require removing the pixels from CMS.
- Installation of the BPix was tested in 2002 with a mock up.

  Test was repeated in May 2006 with Mock ups of BPix, FPix and BCM.
- **Paolo Petagna: Summary Installation Pixels**: May 5 2006.
  This report serves as a working document for the pixel installation.
- The FPix installation plans were presented June 16, 2006 at an EDR at CERN.

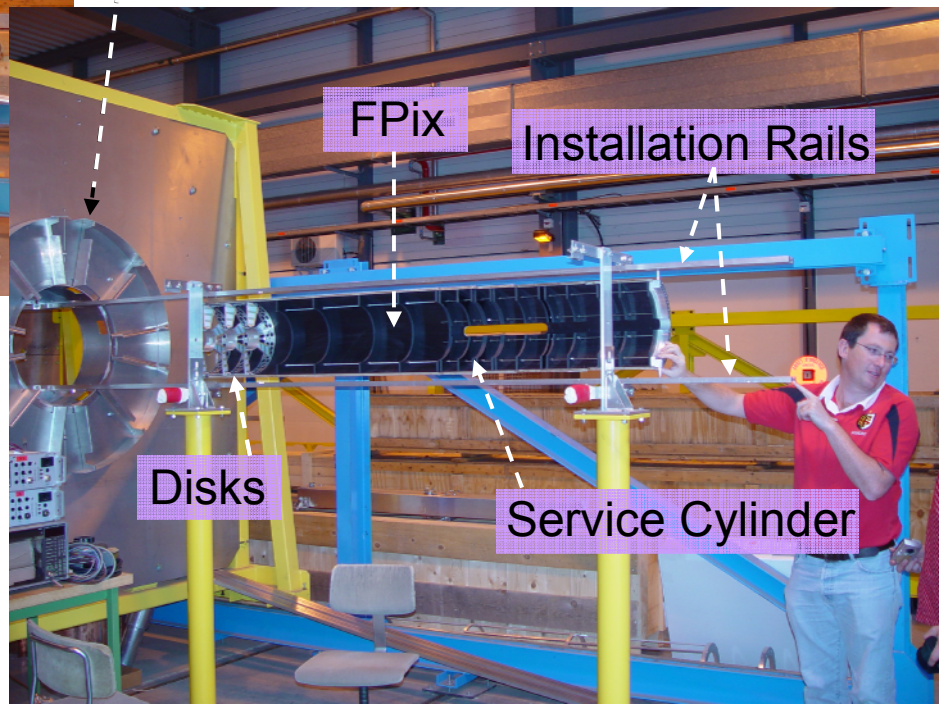


Mockup CMS Tracking



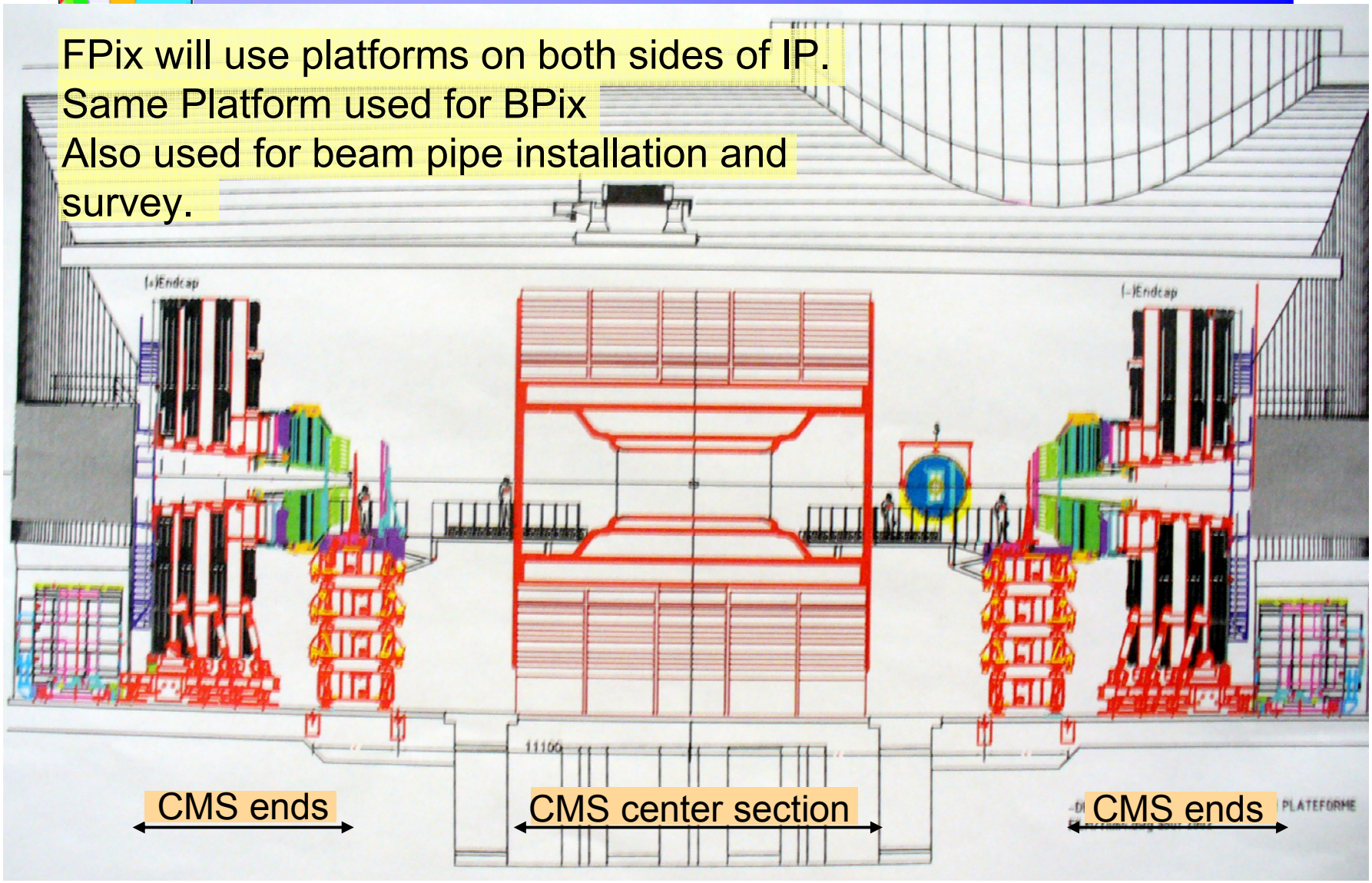
Successful Pixel & BCM Installation Test in May 2006

Vertical planes defining the cylindrical volume reserved for the installation of the Pixels and beam monitoring instruments.



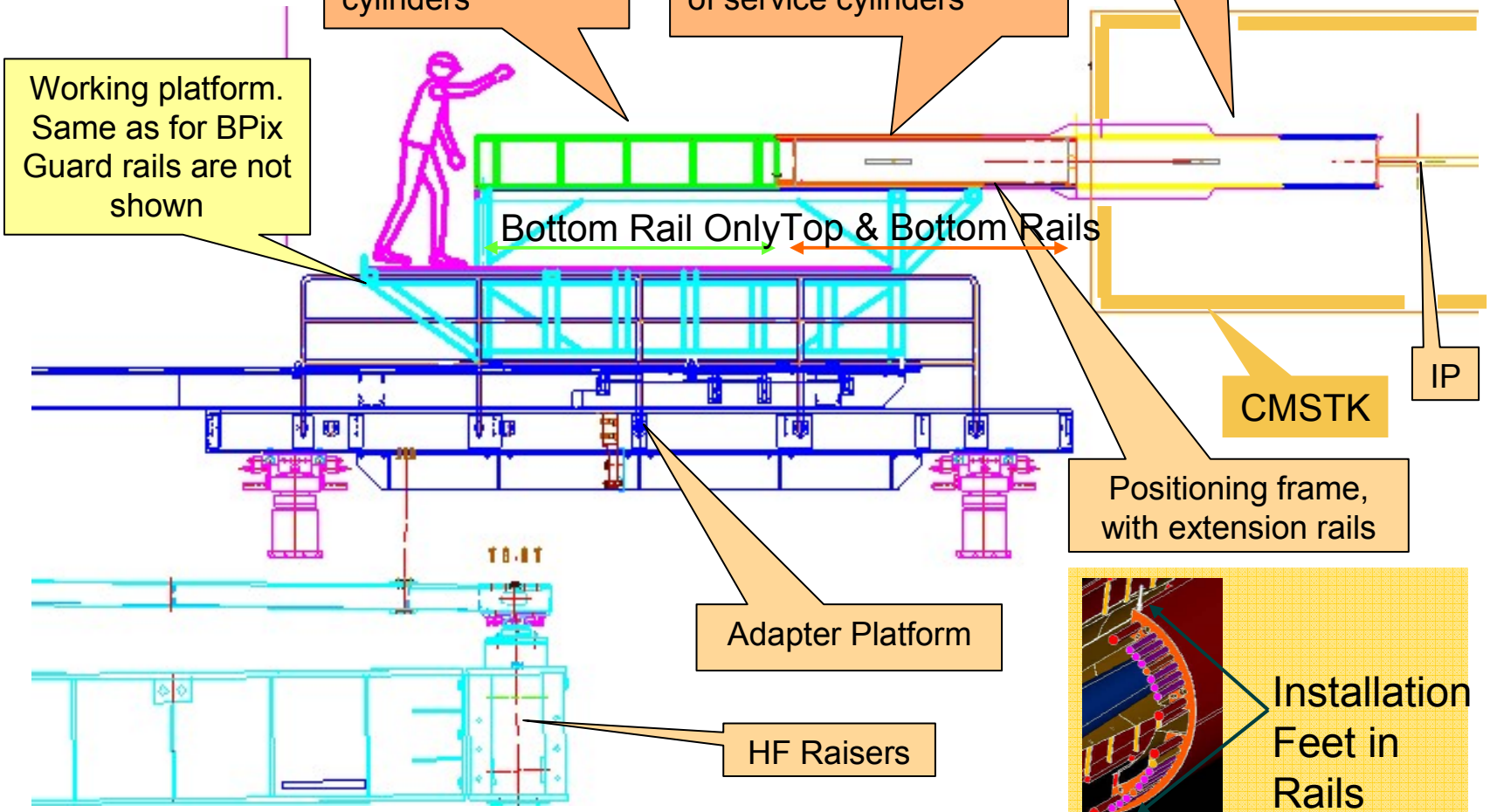
CMS in 'Open Geometry'

FPix will use platforms on both sides of IP.
Same Platform used for BPix
Also used for beam pipe installation and survey.

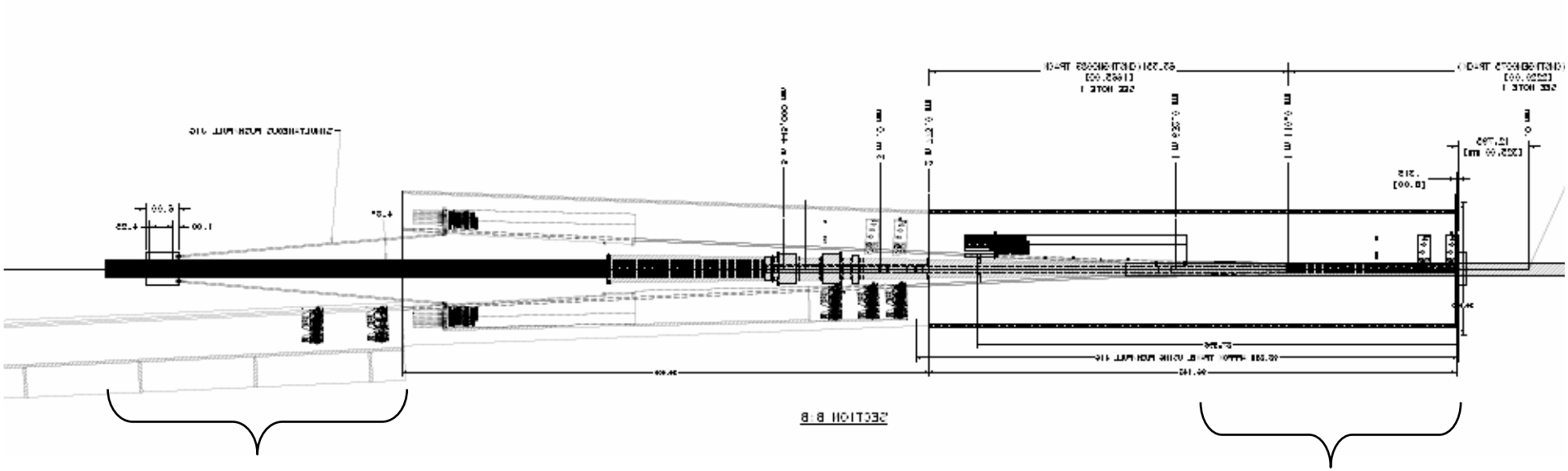


Installation sequence – elevation view

Side View



Installation sequence – plan view

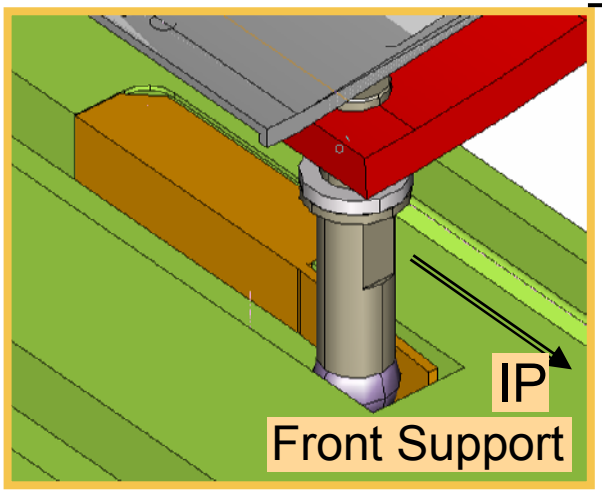


Installation position for stage 1

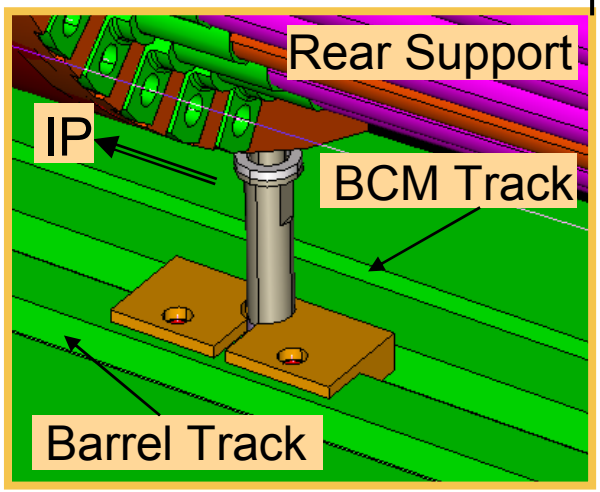
Rails converge and disks interleave in this region of stage 3

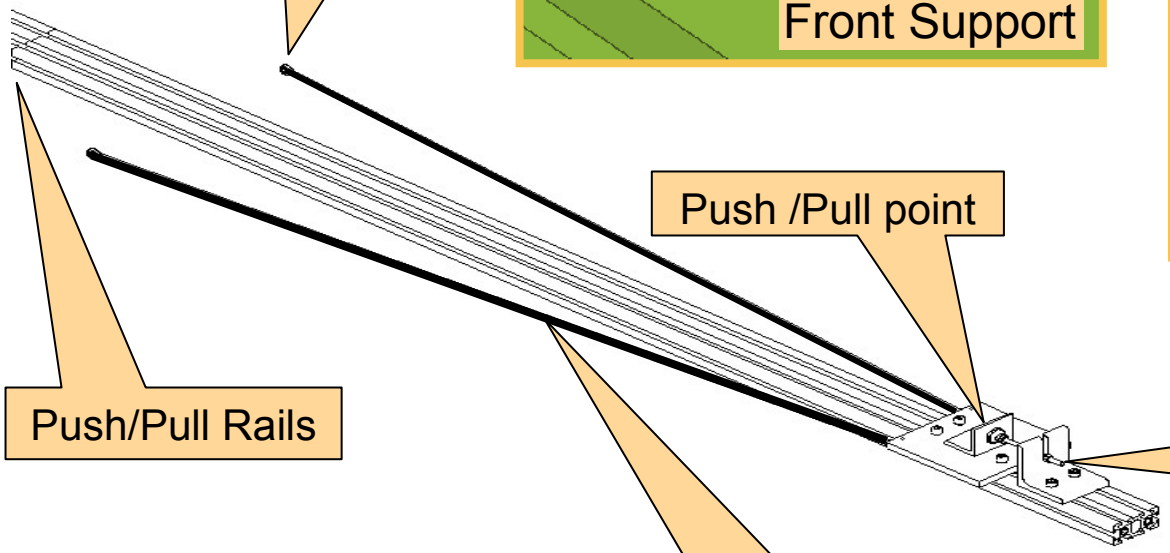
Synchronized Push/Pull Device

This end connects to the Service Cylinder through the corner bracket with a universal joint



Locking of feet of ½-Service Cylinder





Push/Pull Rails

Push /Pull point

Fine Adjustment Nut

Push Rod

All commercial parts

Installation task scope

- Coordination with CMS staff on requirements for “working platform” used by multiple groups
- Design and construction of a fixture for moving service ½ cylinders
- Design and construction of fixtures for stage 1 – stage 3 motion
  - Rails that bridge to the permanent rails
  - Synchronized Push/Pull device
- Evaluate and protect for transportation loading
- Prepare transportation and installation procedures

Summary

- Production of first 1/3 of cooling channels indicates that yield and production rate will not be a problem
- 80 % of the cooling channels will be complete in ~ 4 weeks
- Service ½ cylinder carbon fiber assembly is ahead of the required schedule
- Designs of 4 remaining items have been completed
  - Evaluation of mounts and covers will be completed shortly
  - Production fabrication of many of the components are underway
  - Fabrication of remaining keys items will be expedited for the first ½ cylinder
- Conceptual design of installation equipment exists
- Detail design of installation equipment will start in January 07
  - Design to be completed by March 07
  - Fabrication and testing will be completed by June 07